

1     CLAIMS:

2           1.     A conductive integrated circuit metal alloy interconnection  
3     comprising an alloy of copper and silver, with silver being present in  
4     the alloy at from less than 1.0 at% to 0.001 at%.

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6           2.     The interconnection of claim 1 wherein silver is present in  
7     the alloy at from 0.005 at% to 0.1 at%.

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9           3.     The interconnection of claim 1 having higher electromigration  
10    resistance than copper of a purity of greater than 99.999% of the same  
11    grain size.

12  
13          4.     The interconnection of claim 1 having greater thermal  
14    stability to grain size retention and crystal orientation retention than  
15    copper of a purity of greater than 99.999% of the same grain size.

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17          5.     A physical vapor deposition target comprising an alloy of  
18    copper and silver, with silver being present in the alloy at from less  
19    than 1.0 at% to 0.001 at%.

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21          6.     The physical vapor deposition target of claim 5 wherein  
22    silver is present in the alloy at from 0.005 at% to 0.1 at%.

1           7.    The physical vapor deposition target of claim 5 comprising  
2    an RF sputtering coil.

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4           8.    An electroplating anode comprising an alloy of copper and  
5    silver, with silver being present in the alloy at from less than 1.0 at%  
6    to 0.001 at%.

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8           9.    The electroplating anode of claim 8 wherein silver is present  
9    in the alloy at from 0.005 at% to 0.1 at%.

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11          10.   A metal alloy for use as a conductive interconnection in an  
12   integrated circuit comprising copper and silver, with silver being present  
13   in the alloy at from less than 1.0 at% to 0.001 at%.

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15          11.   The metal alloy of claim 10 wherein silver is present in the  
16   alloy at from 0.005 at% to 0.1 at%.

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18          12.   A conductive integrated circuit metal alloy interconnection  
19   comprising an alloy of copper and silver, with silver being present in  
20   the alloy at from 50 at% to 70 at%.

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22          13.   The interconnection of claim 12 wherein silver is present in  
23   the alloy at from 55 at% to 65 at%.

14. The interconnection of claim 12 wherein silver is present in the alloy at about 60 at%.

15. The interconnection of claim 12 having higher electromigration resistance than copper of a purity of greater than 99.999% of the same grain size.

16. The interconnection of claim 12 having greater thermal stability to grain size retention and crystal orientation retention than copper of a purity of greater than 99.999% of the same grain size.

17. A physical vapor deposition target comprising an alloy of copper and silver, with silver being present in the alloy at from 50 at% to 70 at%.

18. The physical vapor deposition target of claim 17 wherein silver is present in the alloy at from 55 at% to 65 at%.

19. The physical vapor deposition target of claim 17 wherein silver is present in the alloy at about 60 at%.

20. The physical vapor deposition target of claim 17 comprising an RF sputtering coil.

1           21. An electroplating anode comprising an alloy of copper and  
2 silver, with silver being present in the alloy at from 50 at% to 70 at%.

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4           22. The electroplating anode of claim 21 wherein silver is  
5 present in the alloy at from 55 at% to 65 at%.

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7           23. The electroplating anode of claim 21 wherein silver is  
8 present in the alloy at about 60 at%.

9  
10          24. A metal alloy for use as a conductive interconnection in an  
11 integrated circuit comprising copper and silver, with silver being present  
12 in the alloy at from 50 at% to 70 at%.

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14          25. The metal alloy of claim 24 wherein silver is present in the  
15 alloy at from 55 at% to 65 at%.

16  
17          26. A conductive integrated circuit metal alloy interconnection  
18 comprising an alloy of copper and tin, with tin being present in the  
19 alloy at from less than 1.0 at% to 0.001 at%.

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21          27. The interconnection of claim 26 wherein tin is present in  
22 the alloy at from 0.01 at% to 0.1 at%.

1           28. The interconnection of claim 26 having higher  
2 electromigration resistance than copper of a purity of greater than  
3 99.999% of the same grain size.

4  
5           29. The interconnection of claim 26 having greater thermal  
6 stability to grain size retention and crystal orientation retention than  
7 copper of a purity of greater than 99.999% of the same grain size.

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9           30. The interconnection of claim 26 having an electrical  
10 resistivity of less than 1.8 microohms.cm.

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12           31. A physical vapor deposition target comprising an alloy of  
13 copper and tin, with tin being present in the alloy at from less than  
14 1.0 at% to 0.001 at%.

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16           32. The physical vapor deposition target of claim 31 wherein tin  
17 is present in the alloy at from 0.01 at% to 0.1 at%.

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19           33. The physical vapor deposition target of claim 31 comprising  
20 an RF sputtering coil.

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22           34. An electroplating anode comprising an alloy of copper and  
23 tin, with tin being present in the alloy at from less than 1.0 at% to  
24 0.001 at%.

1           35. The electroplating anode of claim 34 wherein tin is present  
2 in the alloy at from 0.01 at% to 0.1 at%.

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4           36. A metal alloy for use as a conductive interconnection in an  
5 integrated circuit comprising copper and tin, with tin being present in  
6 the alloy at from less than 1.0 at% to 0.001 at%.

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8           37. The metal alloy of claim 36 wherein tin is present in the  
9 alloy at from 0.01 at% to 0.1 at%.

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11           38. A conductive integrated circuit metal alloy interconnection  
12 comprising an alloy of copper and one or more other elements, the one  
13 or more other elements being present in the alloy at a total  
14 concentration from less than 1.0 at% to 0.001 at% and being selected  
15 from the group consisting of Be, Ca, Sr, Ba, Sc, Y, La, Ce, Pr, Nd,  
16 Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Ti, Zr, Hf, Zn, Cd,  
17 B, Ga, In, C, Se, and Te.

18  
19           39. The interconnection of claim 38 wherein the one or more  
20 other elements are present in the alloy at a total concentration from  
21 0.005 at% to 0.1 at%.

1           40. The interconnection of claim 38 having higher  
2 electromigration resistance than copper of a purity of greater than  
3 99.999% of the same grain size.

4  
5           41. The interconnection of claim 38 having greater thermal  
6 stability to grain size retention and crystal orientation retention than  
7 copper of a purity of greater than 99.999% of the same grain size.

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9           42. A physical vapor deposition target comprising an alloy of  
10 copper and one or more other elements, the one or more other  
11 elements being present in the alloy at a total concentration from less  
12 than 1.0 at% to 0.001 at% and being selected from the group consisting  
13 of Be, Ca, Sr, Ba, Sc, Y, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy,  
14 Ho, Er, Tm, Yb, Lu, Ti, Zr, Hf, Zn, Cd, B, Ga, In, C, Se, and Te.

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16           43. The physical vapor deposition target of claim 42 wherein the  
17 one or more other elements are present in the alloy at a total  
18 concentration at from 0.005 at% to 0.1 at%.

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20           44. The physical vapor deposition target of claim 42 comprising  
21 an RF sputtering coil.  
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1           45. An electroplating anode comprising an alloy of copper and  
2 one or more other elements, the one or more other elements being  
3 present in the alloy at a total concentration from less than 1.0 at% to  
4 0.001 at% and being selected from the group consisting of Be, Ca, Sr,  
5 Ba, Sc, Y, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb,  
6 Lu, Ti, Zr, Hf, Zn, Cd, B, Ga, In, C, Se, and Te.

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8           46. The electroplating anode of claim 45 wherein the one or  
9 more other elements are present in the alloy at a total concentration  
10 at from 0.005 at% to 0.1 at%.

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12           47. A metal alloy for use as a conductive interconnection in an  
13 integrated circuit comprising copper and one or more other elements,  
14 the one or more other elements being present in the alloy at a total  
15 concentration from less than 1.0 at% to 0.001 at% and being selected  
16 from the group consisting of Be, Ca, Sr, Ba, Sc, Y, La, Ce, Pr, Nd,  
17 Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Ti, Zr, Hf, Zn, Cd,  
18 B, Ga, In, C, Se, and Te.

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20           48. The metal alloy of claim 47 wherein the one or more other  
21 elements are present in the alloy at a total concentration from 0.005  
22 at% to 0.1 at%.



49. A conductive integrated circuit metal alloy interconnection comprising an alloy of copper and one or more other elements, the one or more other elements being present in the alloy at a total concentration from less than 1.0 at% to 0.001 at% and being selected from the group consisting of V, Nb, Ta, Cr, Mo, W, Mn, Tc, Re, Fe, Ru, Os, Co, Rh, Ni, Pd, Pt, Au, Tl, and Pb.

50. The interconnection of claim 49 wherein the one or more other elements are present in the alloy at a total concentration from 0.005 at% to 0.1 at%.

51. The interconnection of claim 49 having higher electromigration resistance than copper of a purity of greater than 99.999% of the same grain size.

52. The interconnection of claim 49 having greater thermal stability to grain size retention and crystal orientation retention than copper of a purity of greater than 99.999% of the same grain size.

1 53. A physical vapor deposition target comprising an alloy of  
2 copper and one or more other elements, the one or more other  
3 elements being present in the alloy at a total concentration from less  
4 than 1.0 at% to 0.001 at% and being selected from the group consisting  
5 of V, Nb, Ta, Cr, Mo, W, Mn, Tc, Re, Fe, Ru, Os, Co, Rh, Ni, Pd,  
6 Pt, Au, Tl, and Pb.

7  
8 54. The physical vapor deposition target of claim 53 wherein the  
9 one or more other elements are present in the alloy at a total  
10 concentration at from 0.005 at% to 0.1 at%.

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12 55. The physical vapor deposition target of claim 53 comprising  
13 an RF sputtering coil.

14  
15 56. An electroplating anode comprising an alloy of copper and  
16 one or more other elements, the one or more other elements being  
17 present in the alloy at a total concentration from less than 1.0 at% to  
18 0.001 at% and being selected from the group consisting of V, Nb, Ta,  
19 Cr, Mo, W, Mn, Tc, Re, Fe, Ru, Os, Co, Rh, Ni, Pd, Pt, Au, Tl, and  
20 Pb.

21  
22 57. The electroplating anode of claim 56 wherein the one or  
23 more other elements are present in the alloy at a total concentration  
24 at from 0.005 at% to 0.1 at%.

1 58. A conductive integrated circuit metal alloy interconnection  
2 comprising an alloy of copper and one or more other elements, the one  
3 or more other elements being present in the alloy at a total  
4 concentration from less than 1.0 at% to 0.001 at% and being selected  
5 from the group consisting of V, Nb, Ta, Cr, Mo, W, Mn, Tc, Re, Fe,  
6 Ru, Os, Co, Rh, Ni, Pd, Pt, Au, Tl, and Pb.

7  
8 59. The interconnection of claim 58 wherein the one or more  
9 other elements are present in the alloy at a total concentration from  
10 0.005 at% to 0.1 at%.